We claim:

1. A method for dewatering a slurry of titanium dioxide having an initial specific gravity of from about 1.01 to about 1.8 using a filtration system comprising a filter stack, a means for oscillating said filter stack, a feed tank, a permeate holding tank, a concentrate removal line and a water source, said filter stack comprising filter disks and diverter trays, wherein the method comprises the steps of:

passing permeate fluid from said permeate holding tank through said filter stack for period of time sufficient to wet said filter disks and diverter trays;

initiating fluid flow from said feed tank while directing concentrate flow from said filter stack to said feed tank;

adding slurry to said feed tank;

adjusting fluid pressure of fluid entering said filter stack to a pressure between about 275 kPa and about 830 kPa;

initiating oscillation of said filter stack; and,

subsequently setting the oscillation amplitude of said filter stack to a distance between about 0.6 cm and about 3.8 cm.

2. The method of claim 1, further comprising the steps of:

initially removing sufficient slurry from said feed tank such that addition of water or permeate to said feed tank will yield a slurry having a specific gravity ranging from about 1.01 to about 1.1.

3. The method of claim 1, wherein the slurry added to said feed tank has a specific gravity of from about 1.4 to about 1.53.

4. The method of claim 1, wherein said filter stack is initially oscillated at an amplitude between about 0.32 cm and about 1.3 cm.

5. The method of claim 4, wherein said filter stack is initially oscillated for a period of time ranging from about 30 to about 120 minutes at the first amplitude setting and is subsequently oscillated for a period of time of about 4 hours at a second amplitude setting.

6. The method of claim 4, wherein the final oscillation amplitude is maintained between about 1.9 cm and about 2.2 cm.

7. The method of claim 1, wherein the step of adding slurry to said feed tank increases the specific gravity of the slurry in said feed tank to a range of about 1.4 to about 1.8.

8. The method of claim 7, wherein the rate of increase of specific gravity is about 0. 1 per hour.

9. The method of claim 7, wherein following the increase in specific gravity of said slurry entering said filter stack, said concentrate removed from said filter stack has a specific gravity ranging from about 2.0 to about 2.3 and said permeate removed from said filter stack has a specific gravity ranging from about 1.0 to about 1.1.

10. The method of claim 1, wherein the permeate fluid passes through said filter stack for a period of time ranging from about 20 minutes to about 16 hours.

11. The method of claim 1, wherein the permeate fluid passes through said filter stack for a period of time ranging from about 1 to about 2 hours.

12. The method of claim 1, wherein the permeate fluid stream exits the filter stack at a fluid pressure of about 34 kPa to about 172 kPa.

13. The method of claim 1, wherein the permeate fluid stream exits the filter stack at a fluid pressure of about 82 kPa to about 110 kPa.

14. The method of claim 1, further comprising the steps of:

monitoring concentrate flow rate and specific gravity;

stopping the flow of slurry from said feed tank following detection of a concentrate specific gravity of greater than about 2.3 when processing a slurry containing the anatase form of titanium dioxide and greater than 2.2 when processing a slurry containing the rutile form of titanium dioxide;

flushing said filter stack;

restoring slurry flow from said feed tank; and,

continuing to monitor concentrate flow rate and specific gravity.

15. The method of claim 14, wherein said step of flushing said filter stack is achieved by replacing the slurry flow from said feed tank with permeate flow obtained from said permeate holding tank.

16. The method of claim 14, wherein said filter stack is flushed for a period of time of at least 100 seconds.

17. The method of claim 14, wherein said filter stack is flushed for a period of time of at least 200 seconds.

18. The method of claim 14, wherein said filter stack is flushed for a period of time of at least 300 seconds.

19. The method of claim 14, wherein the step of flushing takes place for a period of time sufficient to lower the concentrate specific gravity to a range of about 1.0 to about 1.2.

20. A method for dewatering a slurry of titanium dioxide having an initial specific gravity of about 1.01 or greater using a filtration system comprising a filter stack, a means for oscillating said filter stack, a feed tank, a permeate holding tank, a concentrate removal line and a water source wherein the method comprises the steps of:

removing slurry from said feed tank;

adding sufficient water or permeate to said feed tank to reduce the specific gravity of the slurry stored in said feed tank;

passing permeate fluid from said permeate holding tank through said filter stack for period of time ranging from about 20 minutes to about 16 hours;

initiating fluid flow from said feed tank while directing concentrate flow from said filter stack to said feed tank;

adding slurry to said feed tank;

initiating oscillation of said filter stack;

increasing the oscillation amplitude of said filter stack;

setting the oscillation amplitude of said filter stack to a distance between about 0.6 cm and about 3.8 cm;

increasing the specific gravity of the slurry in said feed tank; and,

removing concentrate and permeate from said filter stack.

21. The method of claim 20, further comprising the steps of:

monitoring concentrate flow rate and specific gravity;

stopping the flow of slurry from said feed tank following detection of a concentrate specific gravity of greater than about 2.3 when processing a slurry containing the anatase form of titanium dioxide and greater than about 2.2 when processing a slurry containing the rutile form of titanium dioxide;

flushing said filter stack; and,

restoring slurry flow from said feed tank while continuing to monitor concentrate flow rate and specific gravity.

22. The method of claim 20, wherein following addition of the water or permeate to said feed tank the fluid in the feed tank has a specific gravity in the range of about 1.01 to about 1.1.

23. The method of claim 20, wherein the slurry added to said feed tank has a specific gravity of from about 1.4 to about 1.53.

24. The method of claim 20, wherein said filter stack is initially oscillated at an amplitude between about 0.32 cm and about 1.3 cm.

25. The method of claim 24, wherein said filter stack is initially oscillated for a period of time ranging from about 30 to about 120 minutes at the first amplitude setting and is subsequently oscillated for a period of time of about 4 hours at a second amplitude setting.

26. The method of claim 24, wherein the final amplitude is between about 1.9 cm and about 2.2 cm.

27. The method of claim 20, wherein the step of adding slurry increases the specific gravity of the slurry in said feed tank to a range of about 1.2 to about 1.8.

28. The method of claim 27, wherein the rate of increase of specific gravity is about 0.1 per hour.

29. The method of claim 27, wherein following the increase in specific gravity of said slurry entering said filter stack, said concentrate removed from said filter stack has a specific gravity ranging from about 2.0 to about 2.3 and said permeate removed from said filter stack has a specific gravity ranging from about 1.0 to about 1.1.

30. The method of claim 20, wherein the permeate fluid passes through said filter stack for a period of time ranging from about 1 to about 2 hours.

31. The method of claim 21, wherein said step of flushing said filter stack is achieved by replacing the slurry flow from said feed tank with permeate flow obtained from said permeate holding tank.

32. The method of claim 21, wherein the step of flushing said filter stack takes place for a period of time of at least 100 seconds.

33. The method of claim 21, wherein the step of flushing said filter stack takes place for a period of time of at least 200 seconds.

34. The method of claim 21, wherein the step of flushing said filter stack takes place for a period of time of at least 300 seconds.

35. The method of claim 21, wherein the step of flushing said filter stack takes place for a period of time sufficient to lower the concentrate specific gravity to a range of about 1.0 to about 1.2.

36. A method for dewatering a slurry of titanium dioxide having an initial specific gravity of from about 1.01 to about 1.8 using a filtration system comprising a filter stack, a means for oscillating said filter stack, a feed tank containing a slurry, a permeate holding tank, a concentrate removal line and a water source wherein the method comprises the steps of:

lowering the specific gravity of said slurry stored in said feed tank to a range of about 1.0 to about 1.1;

passing permeate fluid from said permeate holding tank through said filter stack for period of time ranging from about 20 minutes to about 16 hours, said permeate fluid having a specific gravity between about 1.0 and about 1.1;

initiating fluid flow from said feed tank while directing concentrate flow from said filter stack to said feed tank;

adding slurry having a specific gravity of from about 1.2 to about 1.8 to said feed tank;

initiating oscillation of said filter stack at an amplitude between about 0.32 cm and about 0.6 cm;

increasing oscillation of said filter stack to an amplitude between about 0.6 cm and about 1.3 cm;

subsequently setting the oscillation of said filter stack to an amplitude between about 0.6 cm and about 3.8 cm;

increasing the specific gravity of the slurry in said feed tank to a range of about 1.2 to about 1.8;

removing concentrate and permeate from said filter stack, said concentrating having a specific gravity ranging from about 2.0 to about 2.2 when processing a slurry containing the rutile form of titanium dioxide, said concentrate having a specific gravity ranging from about 2.0 to about 2.3 when processing a slurry containing the anatase form of titanium dioxide and said permeate having a specific gravity ranging from about 1.0 to about 1.1;

monitoring concentrate flow rate and specific gravity;

flushing said filter stack upon detection of a concentrate specific gravity of greater than 2.2 when processing a slurry containing the rutile form of titanium dioxide and greater than 2.3 when processing a slurry containing the anatase form of titanium dioxide; and,

restoring slurry flow from said feed tank while continuing to monitor concentrate flow rate and specific gravity.

37. The method of claim 36, wherein the permeate fluid passes through said filter stack for a period of time ranging from about 1 to about 2 hours.

38. The method of claim 36, wherein said filter stack is initially oscillated at an amplitude of about 0.32 cm to about 0.6 cm for about 30 to about 120 minutes.

39. The method of claim 36, wherein the step of oscillating said filter stack at an amplitude between about 0.6 cm and about 1.3 cm is maintained for about 4 hours.

40. The method of claim 36, wherein the final oscillation amplitude is maintained between about 1.9 cm and about 2.2 cm.

41. The method of claim 36, wherein the step of increasing the specific gravity of the slurry in said feed tank to a range of about 1.1 to about 1.8 occurs over a period of time at a rate of increase of about 0.10 per hour.

42. The method of claim 36, wherein said step of flushing said filter stack is carried out by replacing the slurry flow from said feed tank with permeate flow obtained from said permeate holding tank.

43. The method of claim 36, wherein the step of flushing lasts for a period of time of at least 100 seconds.

44. The method of claim 36, wherein the step of flushing lasts for a period of time of at least 200 seconds

45. The method of claim 36, wherein the step of flushing lasts for a period of time of at least 300 seconds

46. The method of claim 36, wherein the step of flushing takes place for a period of time sufficient to lower the concentrate specific gravity to a range of about 1.0 to about 1.2.

47. A method for dewatering a slurry of titanium dioxide using a VSEP filtration system comprising a filter stack, a motor and a concentrate fluid line comprising the steps of:

monitoring concentrate flow rate, concentrate fluid pressure, concentrate specific gravity in said concentrate line;

monitoring motor load;

stopping the flow of said slurry of titanium dioxide to said filter stack following detection of an out of range value for concentrate flow rate, concentrate fluid pressure, concentrate specific gravity or motor load;

flushing said filter stack until the specific gravity of the concentrate exiting the filter stack has been reduced to a range of about 1.0 to about 1.2; and,

restoring flow of said slurry of titanium dioxide to said filter stack.

48. The method of claim 46, wherein the step of flushing the filter stack continues for about 100 seconds.

49. The method of claim 46, wherein the step of flushing the filter stack continues for about 200 seconds.

50. The method of claim 46, wherein the step of flushing the filter stack continues for about 300 seconds.

51. The method of claim 46, wherein said step of flushing said filter stack is carried out by replacing said slurry of titanium dioxide flow to said filter stack with permeate flow obtained from a permeate holding tank.

52. The method of claim 46, wherein said step of flushing said filter stack passes water or permeate fluid through the concentrate out port of said filter stack.

53. The method of claim 46, wherein said filter stack comprises a series of filter disks and diverter trays and further includes the step of converting a portion of said diverter trays to filter disks.

54. The method of claim 46, further comprising the steps of determining the transmembrane pressure;

stopping flow of said slurry to said filter stack when a transmembrane pressure of less than about 207 kPa is detected; and,

flushing said filter stack.

55. The method of claim 46, further comprising the step of monitoring permeate fluid pressure;

stopping flow of said slurry to said filter stack when a permeate fluid pressure of greater than 124 kPa is detected; and,

flushing said filter stack.

56. The method of claim 46, further comprising the steps of:

monitoring fluid pressure of said slurry entering said filter stack;

stopping flow of said slurry when a fluid pressure of about 827 kPa is detected; and,

flushing said filter stack.

57. A method for dewatering a slurry of titanium dioxide using a VSEP filtration system comprising a motor, a concentrate fluid line and a filter stack, said filter stack comprising a series of filter disks and diverter trays, comprising the steps of:

monitoring concentrate flow rate, concentrate fluid pressure, concentrate specific gravity in said concentrate line;

monitoring motor load;

stopping the flow of said slurry of titanium dioxide to said filter stack following detection of an out of range concentrate flow rate, concentrate fluid pressure, concentrate specific gravity or motor load;

converting a portion of said diverter trays to filter disks; and,

restoring flow of said slurry of titanium dioxide to said filter stack.

58. The method of claim 57, wherein about 30% of said diverter trays are converted to filter disks by drilling out diverter plates welded to said diverter trays.

59. The method of claim 57, further comprising the step of flushing said filter stack prior to converting said diverter trays to filter disks.

60. The method of claim 57, further comprising the steps of determining the transmembrane pressure;

stopping flow of said slurry to said filter stack when a transmembrane pressure of less than about 207 kPa is detected; and,

flushing said filter stack prior to converting a portion of said diverter trays to filter disks.

61. The method of claim 57, further comprising the step of monitoring permeate fluid pressure;

stopping flow of said slurry to said filter stack when a permeate fluid pressure of greater than 124 kPa is detected; and,

flushing said filter stack prior to converting a portion of said diverter trays to filter.

62. The method of claim 57, further comprising the steps of:

monitoring fluid pressure of said slurry entering said filter stack;

stopping flow of said slurry when a fluid pressure of about 827 kPa is detected; and,

flushing said filter stack prior to converting a portion of said diverter trays to filter.

63. A filter stack comprising at least two filter disks and at least one diverter tray, said filter disks and diverter tray being arranged in parallel one above the other, each filter disk and each diverter tray comprises a filter membrane support having at least two ports located a distance from the center of said membrane support, at least one layer of filter membrane, and a central permeate passageway, wherein the improvement comprises:

a diverter plate welded over one of the two ports located a distance from the center of said membrane support of said diverter tray thereby substantially blocking fluid flow through said port; and,

said weld attaching said diverter plate over said slurry feed port is a substantially complete weld around the circumference of said diverter plate.

64. The filter stack of claim 63, wherein said diverter plate completely blocks fluid flow through said port.

65. The filter stack of claim 63, wherein said weld attaching said diverter plate over said port is a continuous bead weld around the complete circumference of said diverter plate.

66. A method for preparing and transporting a slurry of titanium dioxide comprising the steps of:

providing a slurry of titanium dioxide having a specific gravity between about 1.1 and about 1.8;

dewatering said slurry of titanium dioxide to yield a concentrate having a specific gravity of about 2.0 to about 2.3 and a permeate having a specific gravity between about 1.0 and about 1.1;

passing said permeate to a permeate holding tank;

passing said concentrate to a concentrate holding tank;

loading said concentrate from said concentrate holding tank into a transportation tank; and,

transporting said concentrate to a finishing plant.

67. The method of claim 66, further comprising the steps of:

monitoring the fluid pressure of said slurry of titanium dioxide to be dewatered;

passing said slurry of titanium dioxide into a filter stack comprising a series of filter disks and diverter trays;

removing said permeate from said filter stack through a first port and removing said concentrate through a second port;

monitoring the fluid pressure of said permeate and said concentrate; and,

monitoring the specific gravity of said concentrate.

68. The method of claim 67, further comprising the step of directing any concentrate having a specific gravity less than about 2.0 back to said filter stack and further dewatering said concentrate.

69. The method of claim 66, wherein said concentrate has a specific gravity between about 2.0 and about 2.3 when said slurry to be dewatered contains the anatase form of titanium dioxide and between about 2.0 and about 2.2 when said slurry to be dewatered contains the rutile form of titanium dioxide.

70. The method of claim 66, wherein said concentrate has a specific gravity of about 2.18.

71. The method of claim 66, wherein said slurry to be dewatered has an initial specific gravity between about 1.4 and about 1.53.

72. The method of claim 66, wherein said filter stack comprises:

at least two filter disks and at least one diverter tray, said filter disks and diverter tray being arranged in parallel one above the other each filter disk, each diverter tray comprises a filter membrane support having at least two ports located a distance from the center of said membrane support, at least one layer of filter membrane, and a central permeate passageway;

a diverter plate welded over one of the two ports located a distance from the center of said membrane support of said diverter tray thereby substantially blocking fluid flow through said port; and,

said weld attaching said diverter plate over said slurry feed port is a substantially complete weld around the circumference of said diverter plate.

73. The method of claim 72, wherein said diverter plate completely blocks fluid flow through said port.

74. The method of claim 72, wherein said filter stack comprises at least 100 filter disks having at least two ports located a distance from the center of said membrane support and at least 10 filter disks having a diverter plate welded over one of said ports wherein said weld attaching said diverter plate over said port is a continuous bead weld around the complete circumference of said diverter plate.

75. The method of claim 72, wherein said weld attaching said diverter plate over said port is a continuous bead weld around the complete circumference of said diverter plate.

76. The method of claim 66, further comprising the step of conditioning said filter stack by passing permeate from said permeate holding tank through said filter stack for period of time

ranging from about 20 minutes to about 16 hours, said permeate having a specific gravity between about 1.0 and about 1.1.

77. The method of claim 76, wherein said permeate passes through said filter stack for a period of time ranging from about 1 to about 2 hours.

78. The method of claim 76, further comprising the steps of:

initially oscillating said filter stack at an amplitude of about 0.32 cm to about 0.6 cm for about 30 to about 120 minutes while passing said permeate through said filter stack;

increasing the oscillation amplitude to between about 0.6 cm and about 1.3 cm and maintaining said amplitude for about 4 hours;

finally setting the oscillation amplitude between about 1.9 cm and about 2.2 cm.

79. The method of claim 78, wherein the specific gravity of fluid passing through said filter stack is increased from an initial specific gravity in the range of about 1.0 to about 1.1 to a final specific gravity in the range of about 1.1 to about 1.8 by increasing the specific gravity of the fluid passing through said filter at a rate of 0.1 per hour.

80. The method of claim 66, further comprising the steps of:

stopping flow of said slurry to be dewatered and flushing said filter stack upon detection of a concentrate specific gravity of greater than 2.2 when processing a slurry containing the rutile form of titanium dioxide and greater than 2.3 when processing a slurry containing the anatase form of titanium dioxide; and,

restoring slurry flow from said feed tank while continuing to monitor concentrate flow rate and specific gravity.